COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
METROPOLITAN BOSTON - NORTHEAST REGIONAL OFFICE

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#192

FEB 27 1998

Olin Corporation
P.O. Box 248
Lower River Road
Charleston, TN 37310
ATTN: Stephen Morrow

RE: WILMINGTON-
Olin Chemical
51 Eames Street
DEP RTN: 3-0471
Supplemental Phase II
Conditional Approval

Dear Mr. Morrow:

The Department of Environmental Protection (the Department/DEP) has received and reviewed a report for the subject site entitled: "Supplemental Phase II Report", dated June 1997. The report was jointly prepared by Smith Environmental Technology Corporation (Smith), ABB Environmental Services, Inc. (ABB), Geomega, and PTI Environmental Services on behalf of the Olin Corporation (Olin). The Phase II report includes a Method 3 Human Health Risk Characterization and an Environmental Risk Characterization. The findings of the Supplemental Phase II report are highlighted below:

Phase II Findings

- There are six major areas at the site that are acting as "sources" of soil and groundwater contamination: 1) "Lake Poly", liquid waste disposal areas, and other unlined pits 2) the dense layer of inorganics (top of bedrock/base of aquifer), 3) the surface water drainage system, 4) Plant B production area and tank farm, 5) drum disposal areas A and B, 6) the sulfate landfill.

- The following media at the site are contaminated: surface soil, subsurface soil, groundwater, surface water and sediments

- A bedrock trough, called the Western Bedrock Valley, extends from Olin toward the west reaching a depth of 120 feet beneath the Maple Meadow Brook wetland. Another bedrock trough, called the Eastern Bedrock Valley, does not extend much beyond Olin's property boundary. No other bedrock troughs were identified. Previous reports submitted by Olin referred to a Southwestern Bedrock Valley which was determined to be nonexistent once additional geophysical and subsurface assessment was performed.

- A dense contaminant layer consisting of a denser-than -water solution comprised mainly of sulfate, chloride, ammonia, chromium, sodium, and calcium is currently present within the Western Bedrock Valley, within a bedrock depression at GW-83D beneath the center of the Olin property, and extending under Jewel Drive, and the Altron and Koch facilities. The dense layer is thickest in bedrock depressions. According to the Phase II report, the position of the dense layer has not changed appreciably since the mid-1980s.

- The pH of the dense layer is typically less than 5.15. The dense plume is layered, with the highest concentration of contamination in the lowest pH regions atop bedrock. The contrast in groundwater contaminant concentrations between the dense layer and the overlying groundwater is abrupt such that overlying groundwater concentrations are generally 100-1000 times less than the dense layer concentrations residing only a few feet below. The geochemistry of the groundwater system aids in reducing mobility of certain metals, including chromium, aluminum, iron, and manganese. The solubility of these metals is controlled by precipitation of oxyhyrdroxide solids.

- The dense contaminant layer and the overlying groundwater have different flow dynamics. The dense layer has very low flow velocities and variable flow while the overlying groundwater has a higher flow velocity and more uniform flow.

- The inorganic compounds within the dense layer have separated such that ammonia, chloride, and sulfate are being transported more readily out of and away from the dense layer while aluminum, iron, and chromium within the dense layer remain less mobile due to precipitation and adsorption reactions.

- The bedrock beneath the site has a low permeability and little storage capacity. Therefore, it is not a substantial part of the overall contaminant flow system.

- Chromium in groundwater, surface water and the dense layer appears to be entirely in the trivalent form.

- Ammonia, chloride, sodium, and sulfate concentrations in surface water are substantially lower than corresponding groundwater locations. The report suggests that "natural attenuation and dilution" are controlling solute concentrations in the ditch system.

- Geochemical conditions in the off-property West Ditch and South Ditch cause chromium to be readily removed from the water column via precipitation to various oxyhydroxide and sulfate solids, creating the observed chromium-bearing flocculent which is chemically inert.

- The weir across the South Ditch has modified the groundwater and surface water flow in its vicinity. Groundwater mounding occurs seasonally and has changed the direction of groundwater flow in the area of the West Ditch (off-property) toward the northwest and Altron rather than southeast toward the ditch system. The weir has minimized the discharge of shallow groundwater to the ditches and reduced the creation of additional flocculent, greatly decreasing the inorganic concentrations in the off-property West Ditch and South Ditch. However, the change in groundwater flow direction may have caused some inorganics and VOCs in the shallow groundwater to move further west and may have changed the location of the dominant groundwater discharge points along the South Ditch.

Human Health Risk Characterization Findings/Conclusions

The purpose of a characterization of risk of harm to health, safety, public welfare and the environment is to provide the quantitative and qualitative information used to evaluate whether a level of No Significant Risk exists, as that term is defined in the MCP, and if remedial actions are necessary. The following highlights the findings/conclusions of the human health risk characterization:

- For current and future land use and current and future site conditions, cancer and non-cancer risks are below the corresponding MCP Cumulative Receptor Cancer Risk Limit ($1X10^{-5}$) and Cumulative Receptor Non-cancer Risk Limit (hazard index = 1). However, groundwater exposure point concentrations within the Zone II of the Town of Wilmington's water supply wells exceed Massachusetts Maximum Contaminant Levels, therefore, it **cannot** be concluded that a condition of No Significant Risk exists for public health.

- Due to the potential danger of fire/explosion if future excavation were to occur in drum areas A and B, a condition of No Significant Risk of harm to public safety **cannot** be concluded.

- A condition of No Significant Risk of harm to public welfare **cannot** be concluded because; groundwater exposure point concentrations for several site contaminants including chromium exceed Upper Concentration Limits (UCLs), non aqueous phase liquid is present at a thickness greater than one-half inch in the Plant B area, and a drinking water source has been impacted by site contaminants.

Environmental Risk Characterization Findings/Conclusions

The following highlights the findings/conclusions of the Environmental Risk Characterization:

- Significant toxicity was observed in two locations in the on-property West Ditch. By incorporating the results of toxicity testing into a population model a reduction in frog subpopulations greater than 25% was observed in the on-property West Ditch. This represents an exceedance of the assessment endpoint of 25% reduction in frog subpopulation; therefore, a condition of No Significant Risk cannot be concluded for aquatic receptors. In addition, since surface water quality standards for several inorganic compounds including aluminum, chromium, copper, iron, and lead were exceeded and UCLs for several site contaminants in groundwater were exceeded, a condition of No Significant Risk of harm to the environment cannot be concluded.

- Results from the food chain model support a conclusion of No Significant Risk of harm to aquatic receptors from site contaminants.

- Based on the results of a food chain model which incorporated site-specific tissue concentrations of prey items, it can be concluded that there is No Significant Risk of harm to terrestrial wildlife receptors from reduced prey abundance relative to exposure to site contaminants.

DEP Comments

Please be aware, the Department's Office of Research and Standards is currently reviewing the Environmental Risk Characterization section of the Phase II report. The Department will provide comment on this portion of the Phase II report in a separate document in the near future.

The Department generally agrees with the results and conclusions of the Supplemental Phase II assessment and the Method 3 Human Health Risk Assessment. However, the Department has determined that a few areas of the site require additional assessment, and that several issues relative to the human health risk assessment must be addressed. Since additional assessment is necessary, outstanding human health issues need to be addressed, and the Environmental Risk Characterization is currently under review, DEP cannot grant final approval of the Phase II Comprehensive Site Assessment at this time.

Additional Phase II Assessment Requirements

In order to satisfy the requirements of 310 CMR 40.0830, Phase II - Comprehensive Site Assessment, the Department has determined that the following items must be addressed:

1) The Phase II report infers that a subsurface barrier to flow exists in the vicinity of a bedrock saddle located just west of Main Street. This subsurface barrier was simulated to exist during modelling in order to match the observed field conditions of the dense layer. The existence of this subsurface barrier and must be confirmed and its characteristics documented through the use of geophysical techniques and subsurface borings.

2) A deep groundwater plume identified southwest of the Town of Woburn Landfill requires further characterization to determine whether or not the source of the plume is site-related.

3) The change in shallow groundwater flow direction toward Altron in the area of the West Ditch (which is due to groundwater mounding related to the weir) must be corrected. To this extent, a plan which eliminates both contaminated groundwater migration and flocculent migration off-property must be developed and submitted to DEP for review and approval.

4) Monthly monitoring of Town wells and sentinel wells in the Maple Meadow Brook woodlands proposed in a September 3, 1997 letter from Olin to DEP must continue until DEP approval is granted to discontinue such monitoring.

Additional Human Health Risk Characterization Requirements

DEP has determined that the activities discussed within the Method 3 Risk Characterization Report were performed in accordance with the tasks outlined in ABB's scope of work dated April 1996. The report also addressed the requirements outlined in the Department's May 16, 1996 and March 22, 1995 Risk Assessment Scope of Work Conditional Approval letters. However, several issues that may have an impact on the report's conclusions must be addressed before DEP will grant final approval of the Risk Characterization report. The following requirements must be addressed and incorporated into an addendum to the Method 3 Human Health Risk Characterization report for the subject site:

1) Exposure point concentrations (EPCs) were calculated using post-treatment levels of contamination which is not considered by DEP's Office of Research and Standards (ORS) to be an acceptable methodology for calculating EPCs. The Guidance for Disposal Site Risk Characterization (July, 1995) states that the exposure point concentrations which represent current conditions at public water supply wells should be measured directly at the wellhead and be representative of pre-mixing, pre-treatment conditions. Therefore, EPCs for groundwater taken from the public supply wells must be calculated using pre-treatment levels of contamination since neither mixing nor wellhead treatment is considered permanent and these risk reduction activities may not be considered when estimating baseline exposure point concentrations (section 7.3.3.7.2 of ORS Guidance document).

2) The document entitled "Notice of Limitation with Respect to Groundwater" is a private agreement between the Olin Corporation and the Main Street homeowners to which DEP was not a party. As such, it should not be included with, or referred to in, the risk assessment. ORS and BWSC consider the verified abandonment of the Main Street wells and the connection of the effected residences to a public water supply system, not such private agreement, to be the temporary risk reduction measures which eliminate current drinking water exposures for the purpose of the risk assessment.

ORS and BWSC do not consider a non-MCP sanctioned private agreement to in any way restrict future access to the groundwater under the Main Street residences. Consequently, the risk assessment must consider future use of both the shallow and deep groundwater as potential drinking water sources for those residences. The only mechanism which can eliminate the requirement to assess this future exposure pathway is the placement of a Grant of Environmental Restriction on the Main Street properties. The Grant does not need to be in place at the time of the risk assessment is submitted to the Department, but should be referred to in the risk assessment and in place at the time a Response Action Outcome (RAO) is achieved. While the Grant itself does not limit exposure, it will lock in the limited exposure assumptions addressed in the risk assessment based on risk reduction measures already taken at the site. The risk assessment will become valid at the time the Grant is actually in place as per 310 CMR 40.1071.

3) There is some concern about the methodology used to calculate the Exposure Point Concentrations (EPCs) for some of the soil hot spots. In addition, the use of the term hot spot in the report is not consistent with the MCP definition of a hot spot. Specifically, some concentrations used to calculate certain soil hot spot EPCs are below the applicable Method 1 standard and they differ by three or four orders of magnitude from other concentrations within their grouping. For example, when calculating soil EPCs for the area termed "Lake Poly Hot Spot" (Table 28) the concentrations of chromium range from 68-17000 ppm, and the hot spot EPC is calculated to be 2316 ppm; the concentrations of bis(2-ethylhexyl)phthalate range from 0.97-6700 ppm, and the hot spot EPC is calculated to be 903 ppm. Ammonia and N-nitrosodiphenylamine concentrations in soil and the calculated hot spot EPC values yield similar results for the Lake Poly Hot Spot. The MCP requires that the Exposure Point Concentrations calculated provide a conservative estimate of the concentration contacted by the receptor at the Exposure Point over the period of exposure (310 CMR 40.0926(3)). By referring to areas with a wide range of concentrations as a hot spot, it appears that the calculation of EPCs for these area may be diluting out some very high levels of contamination and creating hot spot EPCs that are not sufficiently conservative. The MCP definition of a hot spot does not preclude the possibility of a hot spot <u>within</u> a hot spot. If there are areas within a defined hot spot which are 10-100 times the concentration in the defined hot spot, then those areas must be looked at as separate Exposure Point Concentrations as well.

4) In calculating the exposures of an off-site worker (Altron worker) a frequency on 5 events per week was used; this resulted in a Hazard Index of 0.9 for current Altron workers and a Hazard Index of 1 for future Altron workers. Most of the risk (HI = 0.8) was due to inhalation of ammonia from process water used at the plant. The document in Attachment 5 of the report states that the Altron Plant runs 24 hours per day, in three eight-hour

shifts, six days a week based on information obtained from Altron's Environmental Manager, Anthony Cigliano (personal communication, May 7, 1997). Since the Hazard Indices for these employees are close to or at the levels the Department has set as protective for human exposures and to be sufficiently protective of the Altron workers, a frequency of six days per week must be used as the frequency of exposure to calculate risk to these receptors.

5) When looking at the current on-site worker's direct contact with surficial soil the average surface area must consist of not only the head, hands, and arms but also the lower legs, as it appears that this receptor is performing grounds maintenance (based on the frequency of exposure) during the warmer months of the year (Exposure Factors Handbook, EPA May 1989). In addition, the soil ingestion rate of 50 mg-soil/day, which is intended to be representative of adult industrial workers, may not be sufficiently protective for individuals who perform grounds maintenance activities where some type of enhanced exposure may occur through activities such as lawn mowing or landscaping. Typically, a soil ingestion rate of 500 mg-soil/day is used for enhanced exposures such as those experienced by a construction worker. Since grounds maintenance is considered an enhanced exposure, the soil ingestion rate must be increased toward the 500 mg-soil/day range to be conservatively protective. These assumptions must also be applied to the future on-site worker exposure scenario as well.

6) The exposure frequency used in this risk assessment for a construction worker scenario is five days a week for two months. The Department requires that a default exposure frequency of five days per week for six months be used instead of the frequency used, although this revision will not change the conclusions of the evaluation. In this particular case, if the total receptor risk for the construction worker were tripled (to represent an exposure frequency of six months) it would yield an Elevated Lifetime Cancer Risk of 2.7×10^{-7} and a Hazard Index of 0.3 - both of which are still below what the Department has determined to be a level of "no significant risk" for human exposures.

7) Calculations of current and future risk to residents of the Pacheo property should include swimming exposures to contaminants detected in shallow groundwater monitoring wells GW-59S and GW-66S. This is due to the fact that the pool present on this parcel has a valve which allows groundwater to enter the pool when groundwater levels exceed the pool level.

8) The dense contaminant layer resting on the bedrock is acting as a continuing source of contamination to the overlying groundwater. This condition will prevent achievement of a Class A or B Response Action Outcome (RAO), signifying a permanent solution as per 310 CMR 40.1003(5).

9) In the development of the Reference Dose (RfD) for diisobutylene (Attachment 4) three uncertainty factors were applied to account for inter- and intra- species sensitivity, and because the RfD was based on a LOAEL not a NOAEL. According to US EPA protocol, an additional uncertainty factor of 10 should be applied to account for the fact that the chronic oral RfD was based on a sub-chronic study (a two-week oral rat study). Application of this additional factor would result in a chronic oral RfD for diisobutylene of 0.0205 mg/kg/day (20.5 µg/kg/day) which must be used to revise the risk calculations involving this chemical.

10) As many assumptions were made about limitations on exposure, it is important to note that the risk assessment and its conclusions will not be considered valid until the required Activity and Use Limitations (and all other methods used to limit exposures) are in place.

Please note, there is an exception to using the Average Daily Dose (ADD) when calculating exposures resulting from inhalation of particulates. This exception occurs when the contaminants of concern act at the point of contact, e.g. the lungs. In those situations the Average Daily Exposure (ADE) must be calculated.

If you have any questions concerning this letter, please contact Valerie Thompson at (617) 932-7705 or the letterhead address.

Very truly yours,

Valerie A. Thompson
Environmental Analyst

Stephen M. Johnson
Section Chief, Site Management
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